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THE COLUMBIAN GROUND SQUIRREL IN MONTANA

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The Columbian ground squirrel is one of 6 species of ground squirrels found in Montana. The Golden Mantled and Thirteen-lined ground squirrels are of minor importance agriculturally. The Uinta ground squirrel has some economic importance in a small area of Southwestern Montana where it can be troublesome in forage crops and small grains. A squirrel recently assigned new status taxonomically, the Slender ground squirrel, also is found in a small area of Southwestern Montana. Neither the Slender or Uinta ground squirrels have received a lot of attention in Montana from a management standpoint and are basically treated like the Richardson ground squirrel which they closely resemble.

The Columbian ground squirrel is a bushy tailed ground squirrel found in Northern Idaho, Northeastern Oregon, Eastern Washington, British Columbia, Alberta, and the Western fourth of Montana. This squirrel is just slightly smaller than the California ground squirrel, about 300 to 800 grams (3/4 to 1 3/4 pounds) although late summer mature males will approach 1 kilogram. This squirrel is easily identified in Montana by the rufous or reddish brown fur on the forehead, legs and feet, and the mottled brownish-gray back. With experience, vocalizations can be recognized as distinct from other Montana species.

The area of Montana occupied by the Columbian ground squirrel is basically a mountainous region interspersed with relatively narrow alluvial valleys. The valley bottoms and alluvial terraces are farmed, the major crops being small grain, (wheat, barley, oats), hay (alfalfa, grass) and pasture. The Northwestern portion of Montana west of the Continental Divide enjoys some moderation in climate from Pacific weather patterns. This is reflected in a wider variety of crops that include cherries, apples, lentils, peas, garbazos and and mint in addition to those already mentioned.

In this region the eastern range of the Columbian ground squirrel approximates what is called the Rocky Mountains front or the east slope of the Continental divide. Their range does not extend onto the plains. Squirrels in Montana are found at elevations ranging from 3,600 feet near Helena to at least 8,000 feet in alpine regions of the Rockies.

Behavior and Life Cycle

The Columbian ground squirrel is a colonial species unlike Richardson or Uinta ground squirrels that are usually more evenly

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dispersed in the areas they inhabit. On rangeland it is not uncommon to encounter dense colonies interspersed with areas of relatively low density. Populations can become quite dense with numbers of greater than 50 animals per acre being reported in Montana crops. Within colonies, densities may reach greater than 100 animals per acre.

Columbian ground squirrels hibernate from late summer to early spring. This period of dormancy cannot be truly called hibernation because squirrels arise periodically within their burrow systems and there have been reports of squirrels coming above ground during warm weather in the winter. This situation is uncommon in Montana however. Hibernation begins in July, in response to heat, food supply, and accumulated body fat. Adult males hibernate first, followed in a few weeks by adult females, and young of the year may stay active into September. Emergence in the spring occurs in late March or early April depending upon weather conditions and snow cover. Males may emerge as much as two weeks before females however there is some confusion in the literature concerning this. Regardless, emergence of the entire population probably occurs over a 2-3 week span.

After emergence from hibernation, breeding occurs for about a 2 week period, and is followed by 24 days of gestation in females. During gestation and lactation females become more territorial in nature and aggressively defend a small area around their natal burrows. About 4 to 5 young are born about mid May and first appear above ground in early June. During late gestation and early lactation females spend more time in preparing for birth and caring for the newborn young and less time in foraging above ground. For this reason rodent specialists have at times recommended that baiting operations be curtailed after the breeding period and until the young appear above ground and begin foraging independently. This recommendation may have some merit for landowners treating their own fields but is probably impractical for comprehensive.

In a not well understood phenomenon called dispersal, certain members leave their populations for permanent residence elsewhere. These dispersers are usually juveniles or yearlings who may travel as much as 1 mile. Montana studies indicate that relatively few travel more than 250 yards however, and that the majority are males. From a management standpoint this behavior has implications in relation to the reinvasion of treated fields. In Montana, landowners are encouraged to manage at least a 250 yard buffer around fields to minimize the reinvasion potential of dispersing ground squirrels.

Food Habits and Damage

Shortly after emerging from hibernation Columbian ground squirrels probably prefer a diet of green spring vegetation. For this reason early use of grain based baits may be ineffective. As the summers progress and vegetation matures, seeds become a

more important part of their diet. At this time grain baits are usually readily accepted.

Columbian ground squirrels have a dietary fondness for grains, grasses and cultivated legumes that makes them very damaging to Western Montana's staple crops - small grains and hay. In small grains, damage can easily be observed around burrows and on field borders where squirrels have entered to feed on grain plants. Populations commonly reside on the borders and squirrels enter grain fields to feed. Early in the growing season, the squirrels consume growing grain plants and, later, they will consume just the grain kernels. In a ripening grain field that is turning amber, damaged areas are visible as green patches of immature plants. Damage studies conducted in Montana showed that moderate to high numbers of squirrels can remove about one-fourth of a small grains crop.

Alfalfa, a densely planted and fast growing legume, probably can tolerate some feeding by squirrels without significant losses in production. However, recent changes from flood irrigation to sprinkler irrigation by many alfalfa growers have favored colonization of fields by Columbian ground squirrels. Whenever the water tables are low enough to permit dry burrows, squirrels have the potential to reside in this perennial crop. Damage is not usually observable but studies in Montana showed an average loss of 15% of the first cutting and 8% of the second cutting or about 850 pounds per acre. Squirrels usually begin to hibernate several weeks after the first harvest so most of the damage probably occurs to first cutting alfalfa.

Added to losses in crop production caused by feeding is the damage caused by mounds of earth next to rodent burrows. These piles of earth and rock are especially damaging to the sickles of hay mowers, swathers, and combines. Many farmers find this type of damage more disagreeable than the consumption of crops. Damage to sickles results in equipment parts loss, down time to repair equipment, and loss of harvesting efficiency due to damaged equipment. Swathers commonly raise a cloud of dust and explosively scatter soil as the vibrating sickle bars strike a mound. The narrow strips of unharvested or poorly cut hay or grain may then be left as a result of damaged or broken sickle blades. One Montana farmer estimated that he was forced to return to his shop 3 to 4 times daily during hay cutting to repair sickles damaged by Columbian ground squirrel mounds.

Chemical Control Methods

Currently, chemicals and mechanical methods (traps, shooting) are the most effective tools for Columbian ground squirrel management. Very little is known about cultural or biological controls and these areas are badly in need of further investigation.

Certain behavioral and anatomical characteristics may be responsible for the difficulties so far encountered in managing

the Columbian ground squirrel. In Montana, the differences in managing our two economically important ground squirrel species have made it apparent that control methods must be developed for individual species. Methods that are developed for one species and then extrapolated to another may be ineffective or ecologically unsound.

Strychnine and zinc phosphide on oats are both available for ground squirrel management in Montana but so far have been inconsistently effective. Strychnine is very readily absorbed through check pouch linings and is effective against species that collect food in cheek pouches. The Columbian ground squirrel does not pouch foods and does not usually store foods underground. Oat kernels are consumed singly and, because of the rapid onset of strychnine poisoning, symptoms may occur before a lethal dose is consumed. If the resultant nonfatal illness is associated with the strychnine treated grain, "bait shyness" or a reluctance to consume further bait may result. Department of Agriculture studies have shown that with prebaiting and very careful timing, at least 70% control can be obtained, however, private applicators have difficulty in attaining this level of control using strychnine.

Zinc phosphide, another acute toxicant, has not given effective control of the Columbian ground squirrel. Prebaiting with nontoxic bait is necessary when using zinc phosphide in order to accustom squirrels to eating grain. With prebaiting and critical timing, zinc phosphide on rolled oats will probably result in 60 to 80% control.

Compound 1080 (sodium monofluoroacetate)

This controversial acute toxicant on an oat groat carrier will give excellent control of the Columbian ground squirrel. Presently 1080 does not have a permanent registration for use as a field rodenticide in Montana. However, in 1978 Montana documented that Columbian ground squirrel populations in croplands had reached emergency proportions. Under the provisions of an emergency exemption to the Federal rules dealing with pesticides (Section 18, Federal Insecticide, Fungicide and Rodenticide Act), 1080 was used during 1979, 1980 and 1981 in Montana and will probably be used in 1983. In three years of experience, control has commonly been 90% or higher.

In Montana 1080 is used under a strict State-County program. The Montana Department of Agriculture is responsible for obtaining and storing bait, training applicators in proper and safe techniques for applying bait and enforcing restrictions on 1080 use. Counties are responsible for supervising crews and coordinating baiting activities among landowners, crews and the Department of Agriculture.

Hulled, slightly rolled oats (squirreled oats) are used as the carrier and contain 0.05% (500 ppm) sodium monofluoracetate. At this time 1080 can be used to manage only the Columbian ground

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squirrel. The bait is applied by hand with calibrated dippers at the rate of 1 teaspoon scattered per active burrow. Most applications are done by 3-5 crew members, one of whom is a government applicator, who walk the fields. Two counties, however, have begun applying bait from horseback which has several advantages - burrows are more visible, bait is easily scattered, and considerably more acreage can be treated. Horseback applications may become more common in future years of the program.

We encourage all landowners that have fields treated to include at least a 250 yard buffer zone to reduce reinvasion of fields by dispersing squirrels. Experience in Montana has shown that a 100 yard buffer zone was inadequate. Recent research in conjunction with the 1080 program showed that larger buffer zones might protect fields from reinvasion for a longer period, but that, over time, were unjustified economically and environmentally. In the future, the restrictions on buffer zone size will probably be relaxed; however, the Montana Department of Agriculture will continue to recommend that 250 years be treated. Experience has shown that fields properly and thoroughly treated in this manner usually will not require retreatment with 1080 for 1 or 2 years, although alternate management practices might be necessary.

In the 3 recent years that the 1080 program has been in effect, 146,000 acres have been treated. There has been a general trend for total acres to decrease in consecutive years as heavy populations have been brought under control. In the near future 1080 use will probably switch to a maintenance program rather than the emergency program that has been run for 3 years.

A problem that is associated with the use of any acute toxicant such as 1080 is the accidental poisoning of nontarget wildlife and domestic animals. Baits treated with 1080, as well as being directly toxic to grain eating animals, can cause secondary poisoning to scavenging animals who might consume carcasses of poisoned squirrels. The sensitivity of canids to 1080 results in a potential hazard to coyotes, foxes, and domestic dogs. Montana studies have documented that coyote mortalities do occur; and that small mammal populations are locally affected. Corvid species, including magpies and crows, commonly scavenge squirrel carcasses and have been poisoned.

Montana's program has several restrictions directed expressly at reducing hazards to nontarget animals - wildlife, domestic and human. These include scattering the baits, burying squirrel carcasses, notifying adjacent neighbors, posting warning signs, prohibition of use in areas occupied by threatened and endangered species, and training applicators so that they recognize potential problem areas. All suspected nontarget carcasses are analyzed in the Department of Agriculture Analytical Laboratory for the presence of 1080 residues. It is felt that the potential for nontarget poisonings can be reduced by following the proper safety precautions.

Anticoagulants and Bait Stations

In any proper management scheme the reliance on one technique is discouraged. The use of anticoagulants as single dose and multiple dose rodenticides has potential as alternatives to 1080 for controlling Columbian ground squirrels. At this time diphacinone (Ramik Green) is the only anticoagulant registered for ground squirrel control in Montana. Several others including bromadiolone and brodifacoum have been tested, appear promising, and will probably be further developed. Brodifacoum, for example, has an LD_{50} of about 0.13 mg/kg for the Columbian ground squirrel and has given good control of the Richardson in experimental broadcast treatments as a single dose rodenticide.

In Montana Ramik Green has been tested successfully in 3 styles of bait stations - ammo boxes, PVC pipe feeders, and Eco-bait stations. On small acreages where reinvasion potential is negligible, greater than 90% control was achieved. In a 1982 study an average of 5.7 lbs. of Ramik per acre were applied to an effectively treated pasture making the application marginally successful from an economic standpoint. Because squirrels are slow to respond to the toxicity effects of diphacinone, control occurred after 4 to 6 weeks. During a portion of this period squirrels continued to consume bait even though they may have already received a toxic dose. Some additional creative development is probably justified to address this economic problem. Applicators will also need to recognize that diphacinone acts slowly, and have patience in awaiting results.

One positive attribute associated with the use of bait stations is their potential to reduce exposure of toxic baits to nontarget animals. In Montana, wildlife agencies appear to support the concept of bait stations as a method of reducing direct poisoning of birds and other wildlife. Sturdy ait stations can also be used in fields occupied by domestic livestock.

At this time it appears that Ramik in bait stations will be most appropriate on small acreages (no larger than 20 acres) that contain isolated squirrel populations. Examples of these areas are small crop and pasture fields, truck farms, orchards, ranchettes, golf courses, cemeteries, lawns, and ditch and reservoir banks. Montana plans to continue research into the use of Ramik and other coagulants in bait stations and to update recommendations for their use.

Integrated Management System (IMS)

No formal IMS has been developed in Montana for ground squirrel management. Currently, any system for the Columbian ground squirrel on croplands would rely on Compound 1080 as the primary tool. Landowners are encouraged to follow up 1080 treatments by using gas cartridges, shooting or trapping to eliminate residual squirrels. The use of 1080 in successive years on the same field is discouraged.

On smaller acreages or where environmental or human health hazards are of concern, anticoagulants in bait stations, gas cartridges, and trapping are probably the range of effective alternatives.

Rodent Districts

Montana is divided into 56 counties each with the authority to fund a rodent control district. Those counties that choose to do so, usually hire a Rodent Control Supervisor to conduct control programs and implement policy set by the County Rodent Boards. County rodent districts cooperate with the Montana Department of Agriculture where most of the technical expertise on ground squirrel control is located. Any formal management systems that are conceived by the Department of Agriculture must be implemented with the cooperation of County Rodent Districts and private rodent control organizations in order to be successful.